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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/493,603	01/28/2000	Sung-Bae Jun	P-081	2452

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EXAMINER	
NGUYEN, MAIKHANH	
ART UNIT	PAPER NUMBER
2176	8

DATE MAILED: 08/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/493,603	JUN, SUNG-BAE
	Examiner	Art Unit
	Maikhanh Nguyen	2176

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 January 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *3,6,10-12 and 19-21* is/are allowed.

6)☒ Claim(s) *1-2, 4-5, 7-9 and 13-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: *See Continuation Sheet*.

Continuation of Attachment(s) 6). Other: copy of provisional application 60/117695 .

DETAILED ACTION

1. This action is responsive to communications: Amendment A filed 01/16/2004 to the original application filed 01/28/2000.

2. Claims 1-21 are currently pending in this application. Claims 1, 4, 9 and 13 are independent claims.

3. If a copy of a provisional application listed on the bottom portion of the accompanying Notice of References Cited (PTO-892) form is not included with this Office action and the PTO-892 has been annotated to indicate that the copy was not readily available, it is because the copy could not be readily obtained when the Office action was mailed. Should applicant desire a copy of such a provisional application, applicant should promptly request the copy from the Office of Public Records (OPR) in accordance with 37 CFR 1.14(a)(1)(iv), paying the required fee under 37 CFR 1.19(b)(1). If a copy is ordered from OPR, the shortened statutory period for reply to this Office action will not be reset under MPEP § 710.06 unless applicant can demonstrate a substantial delay by the Office in fulfilling the order for the copy of the provisional application. Where the applicant has been notified on the PTO-892 that a copy of the provisional application is not readily available, the provision of MPEP § 707.05(a) that a copy of the cited reference will be automatically furnished without charge does not apply.

Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in (1) an application for patent, published under section 122(b),by another filed in the United States before the invention by the applicant for patent or (2)a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a)shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2)of such treaty in the English language; or " (Emphasis added.)

Claims 1-2, 4-5, 7-9 and 13-18 remain rejected under 35 U.S.C. 102(e) as being anticipated by **Smith et al.** (U.S. 6,223,183).

As to independent claim 1, Smith teaches a method of describing a multiple level digest segment information scheme for multimedia contents in order to provide multiple levels of digest streams for each multimedia content with small amount of additional storage (*uniformly describing space and frequency views... including regions, tilings and hierarchical decompositions of image, video, audio content, and time series data in space, time, frequency and resolution. The space and frequency view description scheme provides a way to specify regions in space, time, frequency and resolution in term of space and frequency views; Abstract)* in accordance with an embodiment comprising the steps of:

- describing the level information of digest segments by multiple levels in the content-based data area of the multimedia stream (*describe any arbitrary multi-resolution decomposition of any number of levels of the image or video data; col.6, lines 41-55);*

- describing the digest level information and the time range information of each digest segment in a digest segment information structure (*the space and frequency view description scheme defines several object classes for specie regions in multi-dimensional rectangular region in space and frequency ...to describe locations, durations, sizes and regions in space and frequency*; col. 7, lines 9-30/ *The view requests can be represented in the form of SFViews to provide a uniform, standard interface for specifying the space, time, frequency and resolution parameters of the views*; *col. 11, lines 15-23)*; and

- describing digest segment information scheme with a set of digest segment information structures (*the space and frequency view description scheme can provide an abstraction layer between image, video and audio description schemes*; *col.10, lines 30-50/it can be important to describe the color of different regions of the image... The space and frequency view description scheme can be used to specify each of the regions in terms of SFViews, and by associating a color measurement function with the space and frequency view description scheme*; *col.12, lines 10-18 and Fig. 15)*.

As to dependent claim 2, Smith teaches the time range information is the start point and end point of or the start point and duration of the digest segment *(col.4, lines 13-65).*

As to independent claim 4, the rejection of independent claim 1 above is incorporated herein in full. However, claim 4 further recites "a digest stream information scheme with a set of digest level headers."

Smith teaches a digest stream information scheme with a set of digest level headers *(col.8, lines 32-45 & Fig. 10).*

As to dependent claim 5, it includes the same limitations as in claim 2, and is similarly rejected under the same rationale.

As to dependent claim 7, Smith teaches the digest level headers can be arranged with the order of importance (level) in order to construct a digest stream from multi level digest segment information scheme fast *(Fig. 10)*.

As to dependent claim 8, Smith teaches the digest level segment information structures can be arranged with the order of their time range information in order to construct a digest stream from multi level digest segment information scheme fast *(col.5, lines 13-65)*.

As to independent claim 9, Smith teaches a method of generating multiple levels of digest streams for multimedia contents (*uniformly describing space and frequency views... including regions, tilings and hierarchical decompositions of image, video, audio content, and time series data in space, time, frequency and resolution. The space and frequency view description scheme provides a way to specify regions in space, time, frequency and resolution in term of space and frequency views*; *Abstract)* in accordance with the present invention comprising the steps of:

- detecting the digest level and time range information of the digest segment information structures from the multiple level digest stream information scheme contained in the content-based data area of the multimedia stream (*the space and frequency view description scheme defines several object classes for specie regions in multi-dimensional rectangular region in space and frequency ...to describe locations, durations, sizes and regions in space and frequency*; col. 7, lines 9-30/ *The view requests can be represented in the form of SFViews to*

provide a uniform, standard interface for specifying the space, time, frequency and resolution parameters of the views; *col. 11, lines 15-23)*;

- when a condition is queried by the user, generating a multiple level digest stream by arranging the digest segments with a priority of more than a certain level corresponding to the condition in a time sequence (*the client can send the requests for different multi-resolution sub-region views to the server. The server can respond by retrieving the views from storage and transmitting the results to the client. The view requests can be represented in the form of SFViews to provide a uniform, standard interface for specifying the space, time, frequency and resolution parameters of the views. The data at the server can also be represented using SFPartitionings or SFHierarchical decompositions to provide a standard way for accessing the views*; *col.10, line 65-col.11, line 23).*

As to independent claim 13, the rejection of independent claim 9 above is incorporated herein in full. However, claim 13 recites:

- a user input unit; and

- a decoder for decoding digest segments of the above digest level from the multimedia stream signal.

Smith teaches:

- a user input unit (*a client application can send requests for views of images*; abstract);

- a decoder for decoding digest segments of the above digest level from the multimedia stream signal (*The view requests can be represented in the form of SFViews to provide a uniform, standard interface for specifying the space, time, frequency and resolution parameters of the views. The data at the server can also be represented using SFPartitionings or*

SFHierarchical decompositions to provide a standard way for accessing the views; *col.11, lines 14-23).*

As to dependent claim 14, Smith teaches the condition is the running time of a digest stream *(col.5, lines 13-53).*

As to dependent claim 15, Smith teaches the condition is one of a time constraint of digest stream, a level information of digest stream, an occurrence of an event, an appearance of a person, a background, an object, situation information about of event, person, object, background *(col.5, lines 13-53 & Figs.12-14).*

As to dependent claim 16, Smith teaches the condition is combination of a time constraint of digest stream, a level information of digest stream, occurrence of events, appearance of persons, backgrounds, objects, situation information about of events, persons, objects, backgrounds *(col.5, lines 13-53 & Figs.12-14).*

As to dependent claim 17, Smith teaches a digest level information and a time range information, and/or the information of the sum of the running time of each digest segment are contained in the digest level *(col.3, lines 14-20 & col.5, lines 13-53).*

As to dependent claim 18, it includes the same limitations as in claim 2, and is similarly rejected under the same rationale.

Allowable Subject Matter

4. Claims 3, 6, 10-12 and 19-21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

5. Applicant's arguments filed 01/06/2004 have been considered but they are not persuasive.

Applicant argues that *because the U.S. Patent and Trademark Office has not provided the Smith provisional application, the outstanding rejection based upon the Smith patent should be withdrawn.* (Remarks, page 10)

In response, a copy of the Smith provisional application is provided, and Smith reference is remained for rejection.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

7. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maikhanh Nguyen whose telephone number is (703) 306-0092. The examiner can normally be reached on Monday - Friday from 9:00am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph H Feild can be reached on (703) 305-9792. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Maikhanh Nguyen
June 28, 2004

J Feild

JOSEPH FEILD
SUPERVISORY PATENT EXAMINER

PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a **PROVISIONAL APPLICATION** under 37 CFR 1.53(b)(2).

DOCKET NUMBER	YO999-043	Type a plus (+) inside this box	+

INVENTOR(s)/APPLICANT(s)

LAST NAME	FIRST NAME	MIDDLE INITIAL	RESIDENCE (City and either State or Foreign Country)
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TITLE OF THE INVENTION (280 characters max)

Method for Describing Views in Space, Time, Frequency, and Resolution

CORRESPONDENCE ADDRESS

Kevin M. Jordan; IBM Corporation; Intellectual Property Law Dept.;
P.O. Box 218; Yorktown Heights, New York 10598

STATE	New York	ZIP CODE	10598	COUNTRY	USA

ENCLOSED APPLICATION PARTS (check all that apply)

[X] Specification Number of Pages 15 [ ] Small Entity Statement

[X] Drawing(s) Number of Sheets 12 [ ] Other (specify)

METHOD OF PAYMENT (check one)

[ ] A check or money order is enclosed to cover the Provisional filing fees [X] The Commissioner is hereby authorized to charge filing fees and credit Deposit Account Number 09-0468	**PROVISIONAL FILING FEE AMOUNT ($)**	$150.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[X] No

[ ] Yes, the name of the U.S. Government agency and the Government contract number are: ___

Respectfully submitted,

SIGNATURE Kevin M. Jordan Date: 1/29/99

TYPED or PRINTED NAME Kevin M. Jordan Registration No. 40,277

[ ] Additional inventors are being named on separately numbered sheets attached hereto.

PROVISIONAL APPLICATION FILING ONLY

Express Mail Label: EL295371781US
Date of Deposit: January 29, 1999

Method for Describing Views in Space, Time, Frequency, and Resolution

John R. Smith and Chung-Sheng Li

Related Applications

The following commonly assigned, co-pending patent applications are hereby incorporated by reference in their entirety:

S/N 09/079,986 entitled "Interactive Retrieval and Caching of Multi-dimensional Data," by Castelli et al., IBM Docket No. YO998191; and

S/N 09/079,662 entitled "Interactive Representation and Retrieval of Multi-dimensional Data Using View Elements," by Castelli et al., IBM Docket No. YO998111

Field of the Invention

The present invention relates to a method for describing locations, sizes, regions, tilings and hierarchical decompositions of image, video and audio content in space, time, frequency and resolution; for providing an abstraction layer between image, video and audio description schemes and multimedia applications and the stored, compressed data, which allows the data to be referenced and accessed in terms of space and frequency views; for providing a view indexing system using a space and frequency graph (SFGraph); for communicating view requests and descriptions between client and server in retrieval applications; for describing multi-dimensional shapes in terms of sets of views; for adding attributes to objects, annotations, meta-data and descriptors that specifies information about locations, sizes, and regions in space, time, frequency and resolution; and for specifying the derivation of descriptors that utilize statistical measures computed from regions in space, time, frequency and resolution.

Background

MPEG-7 is standardizing the interface for multimedia content search engines and filtering agents. The objective is to encourage the creation of standard meta-data to be published with the multimedia content. This will improve the ability by which the content can be indexed, searched, browsed, filed and filtered in a large number of multimedia storage and retrieval applications.

Towards this end, multimedia search, retrieval and filtering applications need a standard reference system for dealing with regions, locations and sizes along the dimensions of space, time, resolution, and frequency. In many cases, they need to deal with these dimensions explicitly, such as when referring to spatial regions of images, temporal units of video, low-resolution versions of images, or spectral bands of audio. The applications also need to be able to refer to regions and locations in space, time, resolution and frequency without concern for the underlying storage and compression formats for the image, video and audio data. The applications need this higher-level interface to insulate them from the specific details of the data bit-streams and view extraction methods. In order to enable this abstraction, a standardized description scheme is needed for specifying location, size and division along the dimensions of space, time, frequency and resolution as they pertain to the image, video and audio data, and for relating the views of the data with the data storage formats.

Independent of the storage and compression formats, digital multimedia content such as images, video and audio has an inherent lattice structure. For example, image data consists of pixels that are samples on a 2-D spatial grid. Similarly, audio and video data consists of samples in time, or in space and time, respectively. Spatial and temporal views, such as spatial quadrants of an image or temporal segments of video correspond to the data in parts of the lattice.

Frequency views, such as low-resolution images, wavelet subbands, or temporal-frequency channels correspond to segments of the data after transformed into the frequency domain. This allows us to develop a general notion of views of image, video and audio content - a view is a region in multi-dimensional space (includes time) and multi-dimensional frequency (includes resolution) that has location and size. Since multimedia applications need to deal with views all the time, a standard description scheme (DS) is needed to describe views.

Summary of The Invention

In accordance with the aforementioned needs, the present invention is directed towards a method for describing locations, sizes, regions, tilings and hierarchical decompositions of image, video and audio content in space, time, frequency and resolution; for providing an abstraction layer between image, video and audio description schemes and multimedia applications and the stored, compressed data, which allows the data to be referenced and accessed in terms of space and frequency views; for providing a view indexing system using a space and frequency graph (SFGraph); for communicating view requests and descriptions between client and server in retrieval applications; for describing multi-dimensional shapes in terms of sets of views; for adding attributes to objects, annotations, meta-data and descriptors that specifies information about locations, sizes, and regions in space, time, frequency and resolution; and for specifying the derivation of descriptors that utilize statistical measures computed from regions in space, time, frequency and resolution.

The Space and Frequency View (SFV) Description Scheme (DS) provides a way to specify regions in space, time, frequency and resolution in terms of space and frequency views. This allows a more rigorous definition and common understanding of terms such as

"half-resolution," "upper-right quadrant," or "high-pass band," such as when referring to views of an image. The SFV-DS also provides a way to index these views. This is important in applications of progressive retrieval in which a client application can send requests for views of images stored at a server in terms of an SFGraph index value. The SFV-DS handles the details concerning the access and relationship of views with different resolutions, spatial locations and sizes.

Brief Description of the Drawings

The invention will now be described in detail with specific reference to the appended drawings wherein:

Figure 1. Shows how the SFV-DS provides an abstraction layer between the multimedia applications and other MPEG-7 description schemes (DS) and the storage and compression formats for the data.

Figure 2. Shows the dependency among the SFV-DS object types. A tiling has a set of views, a complete tiling is a tiling that partitions the space and frequency multidimensional space, and a hierarchical decomposition has a number of tilings and/or complete tilings.

Figure 3. Shows examples of space and frequency *views*, *tilings* and *hierarchical decompositions*: (a) 2-D lattice image data, (b) low-resolution image, (c) spatial segment of

image, (d) 4-subband frequency decomposition, (e) 4-segment spatial decomposition, (f) multi-resolution pyramid, (g) spatial quad-tree decomposition, (h) space and frequency graph.

Figure 4. Shows the relationship between the space and frequency descriptors (D) in the SFV-DS.

Figure 5. Shows a class diagram for *N*-dimensional Space and Frequency View descriptor (SFV-D).

Figure 6. Shows class diagrams for *N*-dimensional Space and Frequency Tiling descriptor (SFT-D) and Space and Frequency Partitioning descriptor (SFP-D).

Figure 7. Shows the relationship between the space and frequency hierarchical decomposition (SFHD) descriptors (D) in the SFV-DS.

Figure 8. Shows the class diagrams for *N*-dimensional Space and Frequency Hierarchical Decomposition (SFHD-D) and Space and Frequency Pyramid descriptor (SFPyr-D).

Figure 9. Shows the class diagrams for *N*-dimensional Space and Frequency Tree descriptor (SFTree-D) and Space and Frequency Graph descriptor (SFGraph-D).

Figure 10. Shows the Space and Frequency Graph (SFGraph), which provides a mechanism for indexing space and frequency views that are dyadic in location and size. Each view has an index value according to its position in the SFGraph.

Figure 11. Shows the Video View Element Graph, which indexes view with different resolutions in space and time.

Figure 12. Shows how the SFV-DS provides an interface between the SF-Views and the stored, compressed data stream.

Detailed Description of a Preferred Embodiment of the Invention

The SFV-DS provides a standard way to describe *locations, sizes, views*, *tilings* and *hierarchical decompositions* in space, time, resolution and frequency. The SFV-DS also provides an abstraction layer between the multimedia applications that need multi-resolution sub-region access to image, video and audio data and the storage and compression formats for the data. This eliminates the need for the multimedia applications and the other specific MPEG-7 description schemes (DSs) to be concerned with the underlying data representations and storage formats. This provides a higher-level interface in which the applications use the SFV-DS as a standard way of referring to *space and frequency views*. The SFV-DS has the responsibility of correlating those views with the specific storage and compression schemes.

Figure 1 illustrates the abstraction enabled by the SFV-DS. SFV-DS acts as an interface (110) between different description schemes (DS) (105) and descriptors (D) within multimedia applications and as an interface (125) between the applications (120) and the data storage formats (130). Many of the multimedia applications use DSs and Ds that refer to locations and regions of the data in space, time, frequency and resolution. An Image-DS *objects* that point to sets of spatial regions of an image. A Video-DS proposal defines *events* that correspond to sets of segmented temporal units of video. Other descriptors (D), potentially describe features of regions of images, or scenes of video, or segments of audio. The SFV-DS (110) provides a standard way of defining locations, regions and sizes in space, time, frequency and resolution that enables the DSs (105) and Ds to be able to correlate with each other.

Furthermore, since the multimedia data can be potentially be stored in a large variety of storage and compression formats, the applications need to be insulated from the details of the storage and compression (115). For example, image data can be stored in raw pixel format, JPEG, Flashpix, Tiff, Gif, PNG, and many formats (115). Video and audio similarly can be stored in many different formats, such as MPEG-1, MPEG-2, and so forth. The SFV-DS builds a view interface on top of the storage formats that translates the references to multi-resolution sub-region views in space and time into the appropriate references to and operations on the data streams of the storage and compression formats.

Definitions

In order to provide a common interface for specifying location, size, and regions in space, time, frequency and resolution SFV-DS defines several elements: SF-views (205), SF-tilings (210), SF-partitionings (215), and SF-hierarchical decompositions (220). The relationship between these elements is illustrated in Figure 2. The elements are defined in SFV-DS as follows:

- **SF-View**: An *SF-view* (205) is a rectangular region of arbitrary size and location in multi-dimensional space and frequency.

Two examples of views are shown in Figure 3. Figure 3(b) shows a low-resolution SF-view (310) of an image (305), which corresponds to a low-frequency region. Figure 3(c) shows a spatial SF-view (315), which corresponds to the upper-right quadrant of an image (305). We define an SF-tiling and an SF-partitioning as follows:

- **SF-Tiling**: An *SF-tiling* (210) is a *non-redundant* set of views, where non-redundancy is measured in terms of overlap in space and frequency.

- **SF-Partitioning**: An SF-*partitioning* (215) is an SF-tiling that completely fills the multi-dimensional space in space and frequency.

Together, the completeness and non-redundancy constraints imply that the set of SF-views provides a non-redundant and complete covering of the multi-dimensional space in space and frequency. Two examples of SF-partitionings are shown in Figure 3. Figure 3(c) shows a 4-subband decomposition (320), which forms a uniform tiling in frequency. Figure 3(d) shows a 4-segment spatial decomposition (325), which forms a uniform tiling in space. We define a SF-hierarchical decomposition as follows:

- **SF-Hierarchical decomposition**: An *SF-hierarchical decomposition* (220) is a set of SF-tilings (210) and/or SF-partitionings (215) organized into a hierarchy, in which there is a processing dependency among the SF-views (205) at different levels in the hierarchy.

Figure 3 shows three example hierarchical decompositions. Figure 3(f) shows a multi-resolution pyramid (330), which contains several versions of the image at different resolutions. This type of pyramid is used in the JPEG progressive storage format for storing images at multiple resolutions. Each level of the pyramid contains a tiling with a single view. Only the bottom tiling, full-resolution, is complete. Figure 3(g) shows a spatial quad-tree decomposition (335) in which the image is iteratively decomposed in space. Figure 3(h) shows a space and frequency graph (340), in which the image is iteratively decomposed in space and frequency.

Definition of SFV-DS

The SFV-DS provides a way to describe the SF-views, SF-tilings, SF-partitionings and SF-hierarchical decompositions in space and frequency as defined above. The SF-views are described by the SF-view descriptor (SFV-D) (405). The SF-tilings in space and frequency,

which can be represented by sets of SF-views, are described by the SF-tiling descriptor (SFT-D) (410). The SF-partitionings, which are specializations of SF-tilings, are described by the SF-partitioning descriptor (SFP-D) (415). The SF-hierarchical decompositions are described by the SF-hierarchical Decomposition descriptor (SFH-D) (420). Their relationship is shown in the class model depicted in Figure 4.

Space and Frequency View (SFV) Descriptor (D)

The SF-view descriptor (SFV-D) defines the object class SFView (505), which gives the location and size of a multi-dimensional rectangular region in space and frequency. The SF-views are meant to be general in the sense that they can have zero size, or full size in space or frequency. This allows them to be used to describe locations, durations, sizes and regions in space and frequency. Each SF-view is defined in terms of two N-dimensional rectangles, one in N-dimensional space, and one in N-dimensional frequency, where N is the dimensionality of the original data, where its dimensionality can be derived from the specific media type, for example, for audio, $N = 1$, for images, $N = 2$, and for video, $N = 3$.

The Rectangle class (510) defines the N-dimensional rectangles with arbitrary location and size, where the these values are normalized with respect to the size of the space to fall in the range (0, 1). The size value indicates the relative size of the rectangle with respect to the size of the space. The location value indicates the relative location of the rectangle with respect to the origin. The rectangle class also has a function intersect (), which measures whether the rectangle intersects with another supplied rectangle.

The SFView class (505) has two rectangles: one in space (SRECT) and one in frequency (FRECT). The SFView class also has a function intersect (), which measures the intersection of the view with another supplied view, where intersection is measured by the intersection of both the SRECT and FRECT rectangles of the SFView with those in the supplied SFView.

Space and Frequency Tiling (SFT) Descriptor (D)

The SF-tiling descriptor (SFT-D) (605) defines a set of SFViews. The number of SFViews in a SFTiling object is given by CNT. The set of SF-views can be complete or incomplete, but is necessarily non-redundant. The SFTiling class (605) has member functions that tests the SFView set for completeness and non-redundancy. The set of SF-views is complete if and only if the SF-views form a complete covering in N-dimensional space and N-dimensional frequency. The set of SF-views is non-redundant if and only if the views do not intersect with each other.

Space and Frequency Partitioning (SFP) Descriptor (D)

The SF-partitioning descriptor (SFP-D) (610) specializes the SFTiling class (605). Since the SF-views form a complete cover in space and time, the SF-partitioning (610) can be defined from a single SF-view kernel. There are a number of ways in which the SF-view kernel can be resized, re-positioned and replicated in order to cover the multi-dimensional space. The TYPE data member gives two replication types: uniform or octave. This field can be extended to consider additional replication types. In TYPE=uniform, the kernel is replicated along each dimension in space and time until the multi-dimensional space is completely covered. In TYPE=octave, the tiling has logarithmically decreasing sized SF-views with increasing FRECT location.

Space and Frequency Hierarchical Decomposition (SFHD) Descriptor (D)

The SF-hierarchical decomposition descriptor (SFHD-D) (720) forms the basis for pyramid (705), tree-structured (710) and graph-structured (715) decompositions in space and frequency.

Space and Frequency Pyramid (SFPyr) Descriptor (D)

The SFPyr class (810) holds an array of SFViews, which are ordered into a hierarchy related to the processing required to generate the SFViews at subsequent levels in the hierarchy. The array index of each SFView gives its level in the SFPyr.

Space and Frequency Tree (SFTree) Descriptor (D)

Similarly, the SFTree class (905) holds an array of SFTilings, which are ordered into a hierarchy related to the processing required to generate the SFTiling at subsequent levels in the hierarchy. The array index of each SFTiling gives its level in the SFPyr.

Space and Frequency Graph (SFGraph) Descriptor (D)

Similarly, the SFGraph class (910) holds an array of SFTrees. The SFGraph forms a directed-acyclic graph (DAG) of SF-tilings in which the SF-views of each tiling are uniformly decomposed in space and frequency to generate the SF-views at the next level of the SFGraph. Since the SFGraph is grown uniformly in space and frequency, the SFGraph defines a space depth (SDEPTH) and frequency depth (FDEPTH).

Space and Frequency Graph (SFGraph) Index

The SFGraph also provides a way to index the SF-views in terms of their position in the SFGraph DAG data structure (see Figure 10). Each view, such as (1010) , that has position and

size that is a power of 2 can be represented by a single node in the SFGraph. For example, view (1010) can be assigned an index value that indicates its position in the SFGraph, in terms of depth in space and frequency and location in the SFTiling plane. This allows that view to be referred to on the basis of its index value. Views that do not have power of two in size and location can be represented by a set of nodes in the SFGraph. This way, an arbitrary rectagular view can be represented by a set of SFGraph index values.

Video View Element Graph (VEG) Index

In video applications, it is neccessary to de-couple spatial-resolution and temporal-resolution and organize the SF-views into a video view element graph hierarchical decomposition. Similar to the case of the space and frequency decomposition, the space and temporal resolution decomposition can be used to index space and temporal resolution views. For example, the view (1115) corresponds to a view of the video sequence with low-spatial and low-resolution. This view can be assigned an index value on the basis of its location in the VEG.

Space and Frequency View and Data Storage Interface

As described in Figure 1, the SFV-DS can provide an abstraction layer between image, video and audio description schemes (DSs) and the stored, compressed data that allows the data to be referenced and accessed in terms of space and frequency views. An example table that contains the abstraction information is illustrated in Figure 12. Since the multimedia data can be potentially be stored in a large variety of storage and compression formats, the applications need to be insulated from the details of the storage and compression. The SFV-DS builds a SF-view interface on top of the storage formats that translates the references of multi-resolution sub-region views in space and time into the appropriate bit-ranges (1205) and operations on the

data streams. Each view (1210) can be assigned a list of bit-ranges (1205), which represent the data needed from the stored and compressed stream in order to extract the view. For example, view V0 (1215) can be accessed by accessing various segments of data from the bit-stream. The view to bit-stream translation table can potential store in addition a description of the processing function that is needed in order to generate the referenced view by processing the extracted bit-stream data.

Extensions

There are many other extensions that are possible that allow the Space and Frequency Description Scheme to include bit-plane, color channels and spectral information.

Filters and Transforms

Additional meta-data can be added to the Space and Frequency classes that describes the specific filters and transforms for generating the views, tilings, paritionings and hierarchical decompositions.

Arbitrary shape multi-dimensional views

Arbitrary shape multi-dimension views correspond to regions in space and frequency that are not necessarily rectangular. These shapes can be approximated by a set of SFViews at a particular resolution, or frequency depth in the SFGraph. Furthermore, by using SFViews from multiple resolutions, or frequency depths in the SFGraph, shapes can be defined at multiple levels of abstraction.

Descriptor attributes

The SFViews can be used as an attribute in a descriptor or description scheme to specify the location and size of a region being referred to. For example, an image description scheme can specify a number of objects and their semantic attributes, such as names, colors, and shapes. An SFView description can be added to each object that gives its location in space, time, resolution and frequency.

Space and Frequency Feature Descriptors

The SFViews can be used in order to describe the derivation of feature descriptors that are computed from regions of the data in space, time, resolution and frequency. For example, an image texture descriptor may give a vector in which each dimension of the vector corresponds to a measure of energy of one of the spatial-frequency subbands of the image. In this case, each of the spatial-frequency subbands can be described as an SFView. This allows the descriptor derivation to be given in terms of a list of SFViews and a measurement function for each or all of the SFViews. This provides a convenient and compact way to define new descriptors and include their derivation as part of the meta-data.

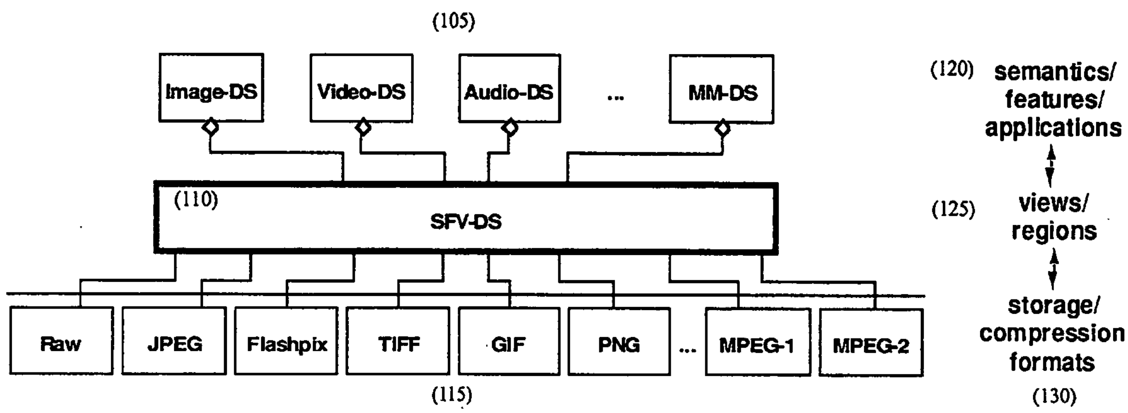


Figure 1. Shows how the SFV-DS provides an abstraction layer between the multimedia applications and other MPEG-7 description schemes (DS) and the storage and compression formats for the data.

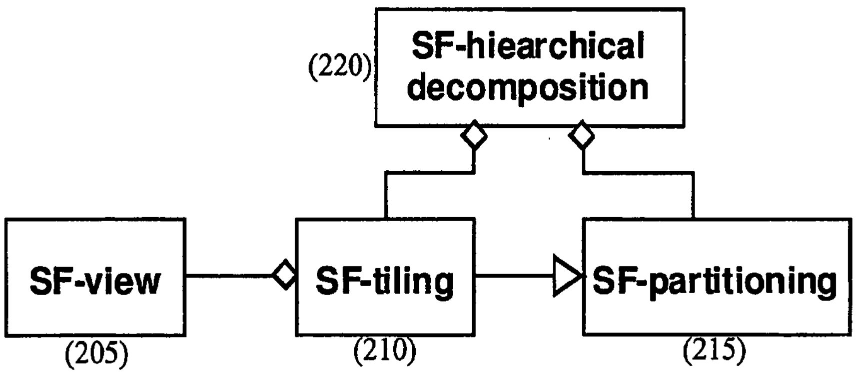


Figure 2. Shows the dependency among the SFV-DS object types. A tiling has a set of views, a complete tiling is a tiling that partitions the space and frequency multidimensional space, and a hierarchical decomposition has a number of tilings and/or complete tilings.

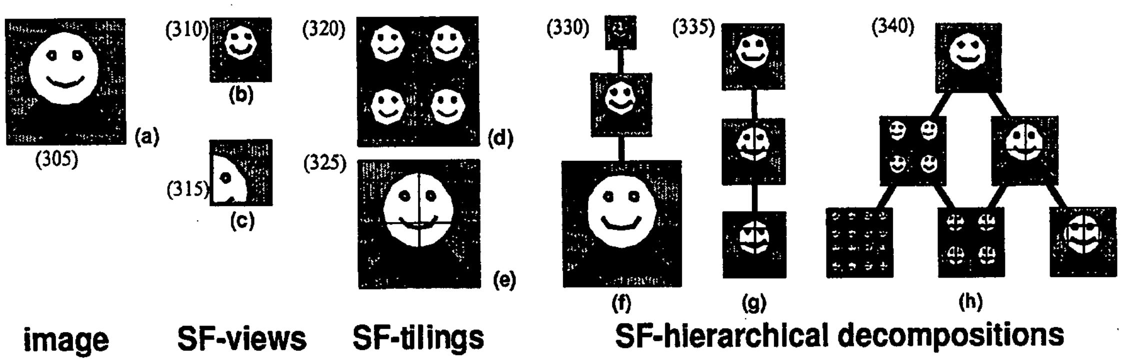


Figure 3. Shows examples of space and frequency *views*, *tilings* and *hierarchical decompositions*: (a) 2-D lattice image data, (b) low-resolution image, (c) spatial segment of image, (d) 4-subband frequency decomposition, (e) 4-segment spatial decomposition, (f) multi-resolution pyramid, (g) spatial quad-tree decomposition, (h) space and frequency graph.

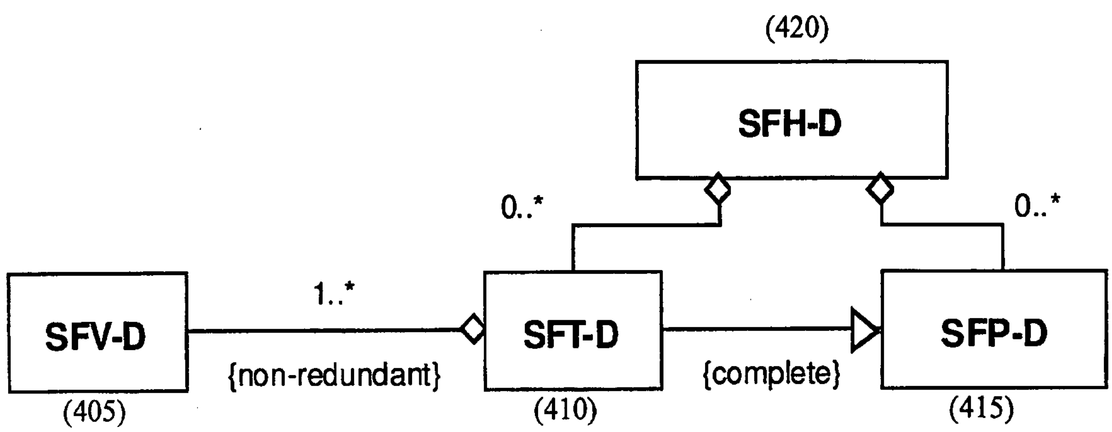
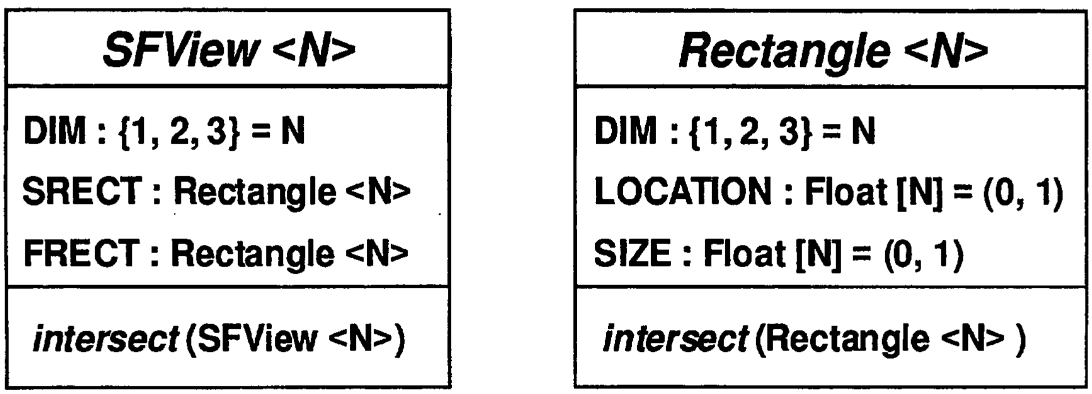


Figure 4. Shows the relationship between the space and frequency descriptors (D) in the SFV-DS.



(505) (510)

Figure 5. Shows a class diagram for *N*-dimensional Space and Frequency View descriptor (SFV-D).

SFTiling <N>
DIM : {1, 2, 3} = N CNT : Integer VIEW : SFVIEW <N> [CNT]
complete () *nonredundant* ()

(605)

SFPartitioning <N> : SFTiling <N>
DIM : {1, 2, 3} = N TYPE : {Uniform, Octave} KERNEL : SFView <N>

(610)

Figure 6. Shows class diagrams for N-dimensional Space and Frequency Tiling descriptor (SFT-D) and Space and Frequency Partitioning descriptor (SFP-D).

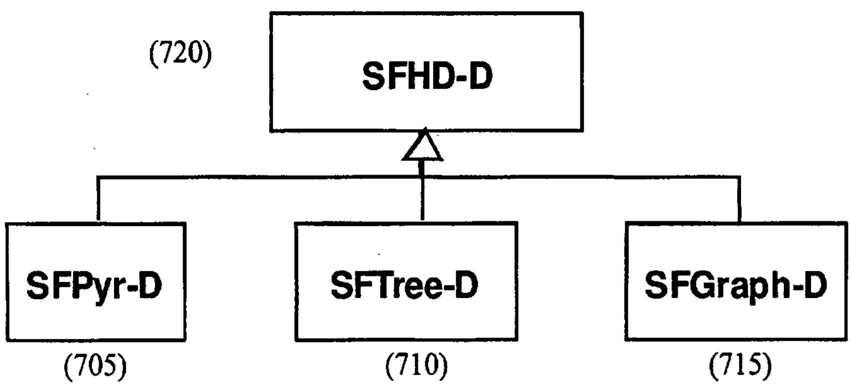
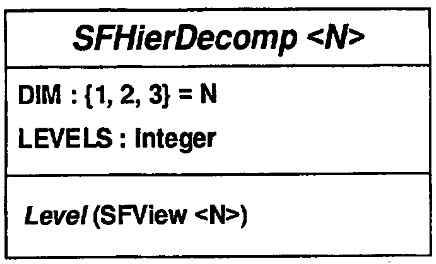
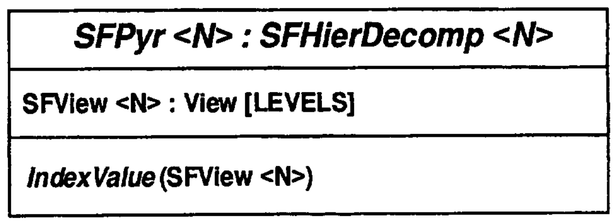


Figure 7. Shows the relationship between the space and frequency hierarchical decomposition (SFHD) descriptors (D) in the SFV-DS.

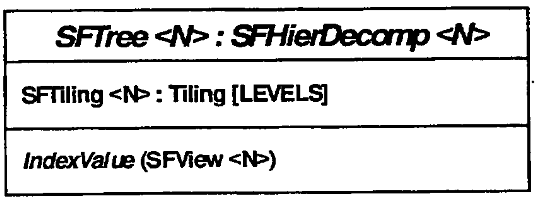


(805)

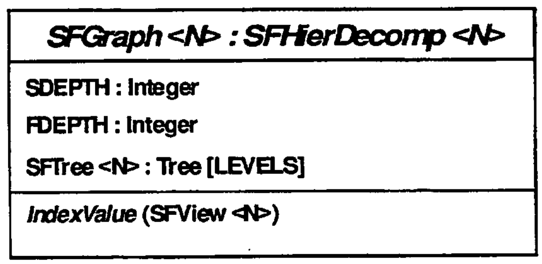


(810)

Figure 8. Shows the class diagrams for *N*-dimensional Space and Frequency Hierarchical Decomposition (SFHD-D) and Space and Frequency Pyramid descriptor (SFPyr-D).



(905)



(910)

Figure 9. Shows the class diagrams for *N*-dimensional Space and Frequency Tree descriptor (SFTree-D) and Space and Frequency Graph descriptor (SFGraph-D).

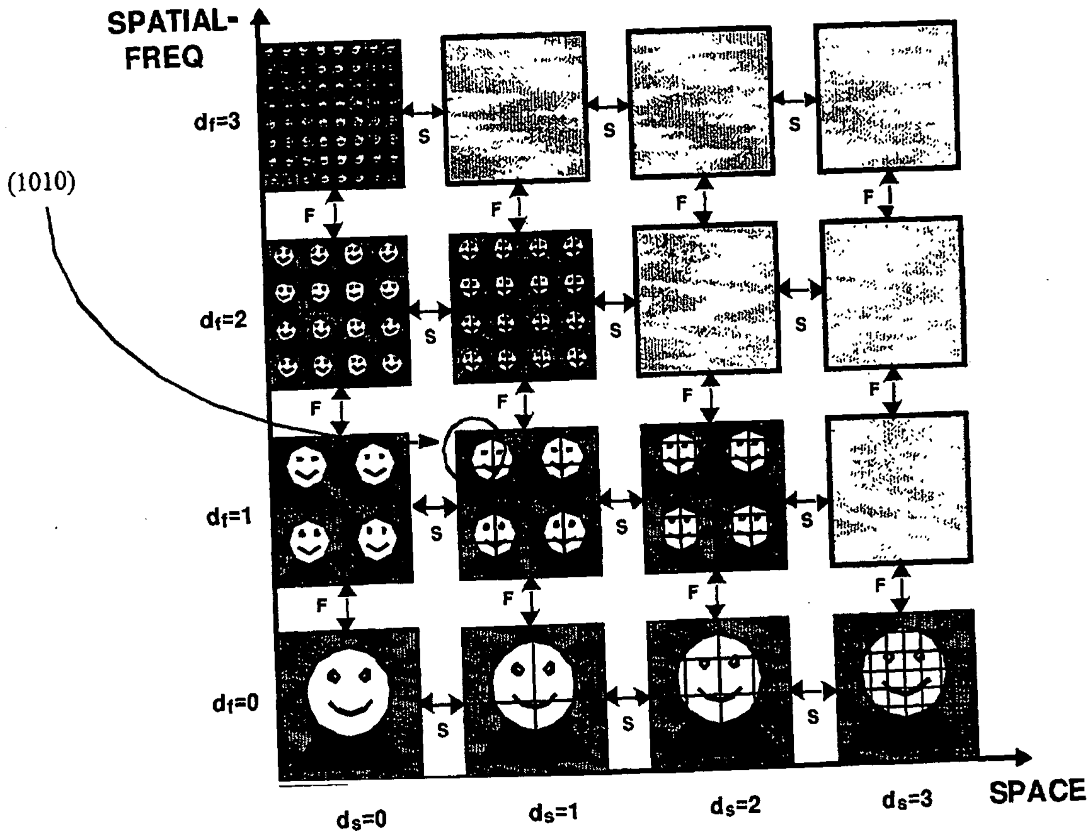


Figure 10. Shows the Space and Frequency Graph (SFGraph), which provides a mechanism for indexing space and frequency views that are dyadic in location and size. Each view has an index value according to its position in the SFGraph.

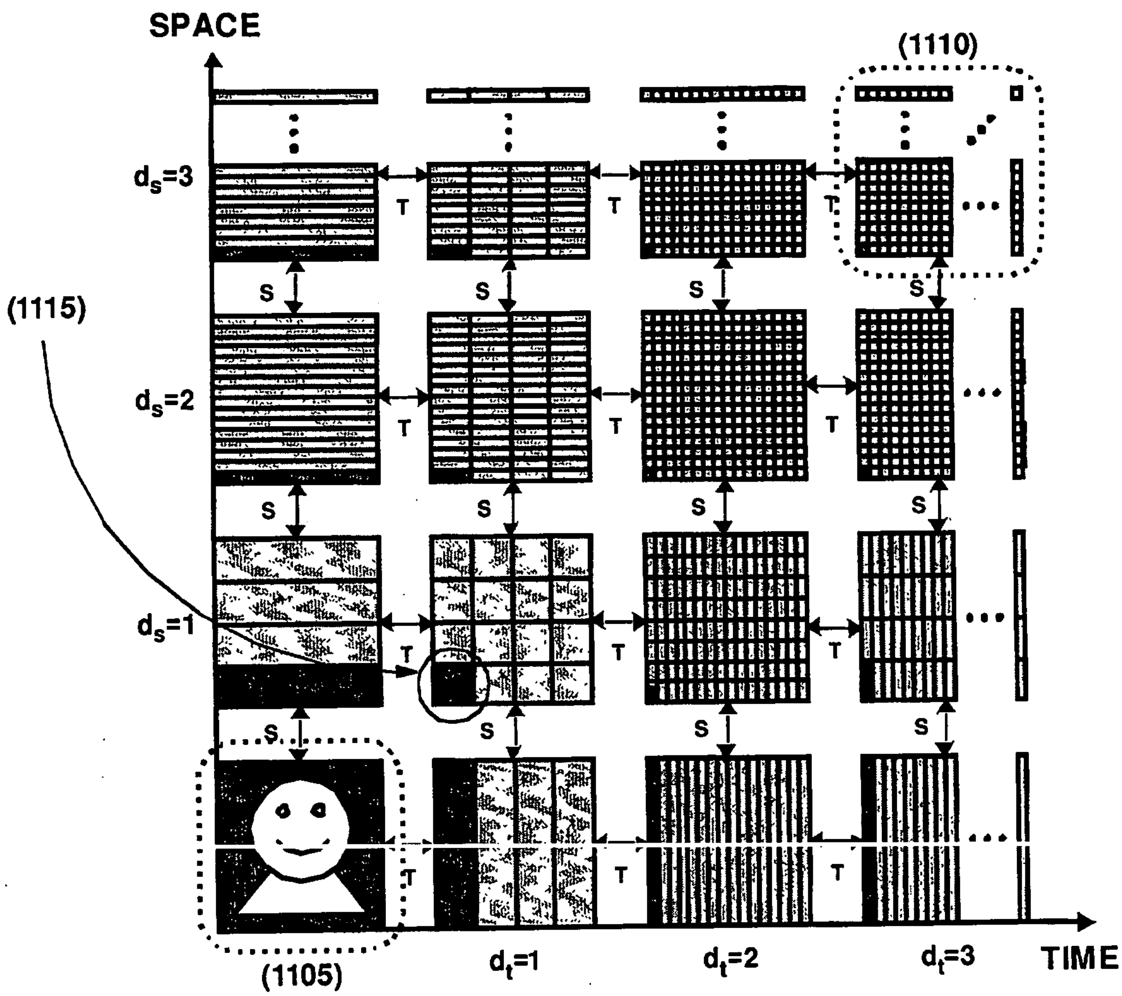


Figure 11. Shows the Video View Element Graph, which indexes view with different resolutions in space and time.

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MEMORANDUM

DATE: October 29, 2004

TO: Patent Examining Corps

FROM: Stephen G. Kunin
Deputy Commissioner
for Patent Examination Policy

SUBJECT: **Termination of transitional practice of supplying a copy of a provisional application relied upon to give prior art effect under 35 U.S.C. § 102(e) to a reference applied in a rejection**

Recently, Internet access to provisional applications that are relied upon for their earlier filing dates in U.S. patent application publications or U.S. patents became available to the public via Public PAIR (Patent Application Information Retrieval). As a result, the transitional practice for supplying a copy of a provisional application relied upon to give prior art effect under 35 U.S.C. § 102(e) to a reference applied in a rejection has ended.

The transitional practice began in December of 2003, and required examiners to: (1) list on the PTO-892 form the provisional application number that gives prior art effect to an applied reference; and (2) include form paragraph 7.82.02 in the written Office action. Now that the transitional practice has ended, these requirements are rescinded. Accordingly, form paragraph 7.82.02 will soon be removed from OACS.

Although the transitional practice has ended, whenever the examiner has a copy of a provisional application relied upon for prior art effect of an applied reference, the examiner may still include the copy with the Office action submitted for mailing (e.g., in the red Action folder). When a copy of a provisional application is included with the Office action submitted for mailing, the examiner should list the provisional application number in the bottom section of the PTO-892 form under the heading "Non-Patent Documents."

If applicant requests a copy of a provisional application relied upon for prior art effect of a reference applied in an Office action, applicant should be referred to the Public PAIR website at http://portal.uspto.gov/external/portal/pair for viewing and/or printing the provisional application. If applicant cannot view or print the provisional application from the Public PAIR website, applicant can still use the Public PAIR website to order a copy of the provisional application. Whether the order for the provisional application copy is placed with the Office of Public Records directly from the Public PAIR website, or by mail (using Mail Stop Document Services), the order requires the fee under 37 CFR 1.19(b)(1).

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Fax Cover Sheet

Date: 20 Aug 2004

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Application/Control Number: 09/493,603	**Art Unit:** 2176
Fax No.: 703-766-3644	**Phone No.:** (703) 305-9792
Voice No.: 703-7663756	**Return Fax No.:** (703) 872-9306
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